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Eye movements reflect comprehenders' knowledge of syntactic structure probability

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Language comprehension is guided by expectation. In this study we show that verb bias influences listeners' expectations about upcoming referents. We look at the dative alternation:

1.	The nurse will feed the soup to the patient	DO-bias, PO realization
2.	The nurse will feed the patient the soup	DO-bias, DO realization
3.	The nurse will bring the soup to the patient	PO-bias, PO realization
4.	The nurse will bring the patient the soup	PO-bias, DO realization

We used Bresnan & al.'s (2007) model of the dative in spontaneous conversational speech to determine the syntactic bias of dative verbs toward the PO construction: the model's Best Linear Unbiased Predictors estimate the bias of the verb, while regressing out the effects of all of the other contextual factors on construction choice. Using this estimate of verb bias, we chose 7 verbs that were biased towards PO, and 7 verbs that were biased towards DO. These verbs were paired to allow the construction of sentences like (1) and (3) or (2) and (4) which only differ in the bias of the verb. Using each verb twice, we constructed 28 items, each with an inanimate patient and an animate recipient. We registered 18 participants' fixations on three objects corresponding to the subject (nurse) and the two arguments (soup and patient) while they listened to the sentences (see Altmann & Kamide, 1999). We removed prosodic cues to realization by using a subject and verb spliced from a DO recording in half of the PO stimuli, and vice versa. If listener's expectations reflect verb-bias, they will fixate on the first argument faster (earlier) when verb-bias matches the realization (2 faster than 4, 3 faster than 1).

The results showed the expected effect; in the given example, participants were faster to fixate the first argument when the verb bias corresponded to the construction spoken ('the soup' when the verb was biased towards a PO realization, 'the patient' after DO-biased verbs) ($ps<.05$). Fixation patterns also reflected the violation of expectation when the realization did not match the verb bias: participants looked more often at the second argument ('the patient' in sentences like 1; 'the soup' in sentences like 4) of the given construction 800-1100 ms after verb-onset (while hearing the first argument) ($ps<.01$).

We can thus conclude that not only semantic and pragmatic expectation, but also syntactic expectations such as knowledge about verb biases play a crucial role in the comprehension of spoken language.

Notes